

THURSDAY, AUGUST 10, 1911.

GYMNOSPERMS.

Morphology of Gymnosperms. By Prof. J. M. Coulter and Prof. C. J. Chamberlain. Pp. xi+458. (Chicago: The University of Chicago Press; London: Cambridge University Press, 1910.) Price 16s. net.

IN 1901 Profs. Coulter and Chamberlain published a short treatise on the Gymnosperms, forming the first volume of their "Morphology of Spermatophyta." Their present work takes the place of this volume, and is practically a new book, designed on a far more liberal scale than its predecessor. The number of pages has grown from 188 to 458, and the illustrations have increased in an even greater proportion. The extension of the book is in no small degree due to the original researches of the authors and their pupils; the special contributions from the Chicago laboratory have amounted to twenty-six since 1901.

"The present account, therefore, is based upon our own work, supplemented by the work of other investigators, rather than a compilation from literature, supplemented by occasional personal observations" (preface).

A striking feature of the book is the prominence now given to palæobotanical evidence.

The book is an invaluable record, admirably illustrated, of our present knowledge of the older type of seed-plants; on reading it one is enabled to realise in what respects essential progress has been made, and where, in spite of the accumulation of detail, there has been little real advance. The latter, less favourable position exists, in the reviewer's opinion, in respect of the Conifers, in which the most fundamental points of morphology and affinity still remain obscure.

The book begins with an account of the Palæozoic class, Cycadofilicales, a name which the authors prefer to the more modern designation, Pteridospermeæ, now generally adopted in England and France. The authors are certainly well advised to include a description of the Pteridosperms in their book, though some botanists have thought it best to keep these fern-like seed-plants of the Palæozoic apart from the Gymnosperms, on the ground of their manifestly primitive characters. In this book there is a tendency to minimise the peculiar features of the Pteridosperms, which mark them off as an archaic group. The entire absence of anything approaching to a strobilus separates them, among other characters, from all Gymnosperms except the female plant of *Cycas*. In any case, however, the close relations between the seed-ferns and the true Gymnosperms are undisputed and of fundamental importance.

The Cycadofilices were recognised as a distinct group before their reproductive organs were discovered. The authors scarcely do justice to this rather impressive instance of the successful use of anatomical characters in determining systematic position; they say:—

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"The striking anatomical feature of the Cycadofilices is the association of secondary wood with a fern-like vascular system. There was no occasion, on this account, to remove Cycadofilices from Pteridophytes" (p. 2).

No one who knew Williamson's work was likely to found a new group on such a basis; other considerations, as, for example, the close agreement between the leaf-trace strands of *Lyginodendrea* and those of Cycads carried much more weight; the authors appear in this instance not to have consulted adequately the original memoirs. They do full justice, however, to the importance of the work done in recent years on morphological anatomy, especially that of the vascular system:—

"Vascular anatomy has emerged as a subject organised upon a morphological basis, and its value in supplementing the older morphology cannot be overestimated" (p. 4).

Though open to some criticism in detail, the account given of the Pteridosperms is on the whole an excellent summary, and will be welcomed by readers who are not familiar with special works on palæobotany.

The interesting question of the constant absence of an embryo in all Palæozoic seeds hitherto investigated is discussed. This has been regarded as the normal condition, the development of the embryo not having begun until after the seeds were shed, and then having passed over at once into germination. The authors, on the other hand, incline to the view that all Palæozoic seeds investigated were abortive, having been shed prematurely. The fact that nearly all the seeds observed are at the same stage of development, and the usual presence of normal pollen in the pollen-chamber scarcely seem consistent with this view.

The remark that the seeds of Pteridosperms

"are very far from being primitive in structure, and are no more suggestive of the origin of seeds in general than are the seeds of existing seed-plants" (p. 34),

appears just, and indicates how much remains to be learnt in this field.

In discussing the relations of the Pteridosperms to the ferns it is pointed out that "Filicales are probably so ancient that all of our evidence is relatively modern" (p. 55).

"The gap between the homosporous *Primofilices* (or their unknown ancestors) and the seed-bearing Cycadofilicales is an enormous one, including the evolution of both heterospory and the seed" (p. 57).

The authors divide Gymnosperms into Cycadophytes and Coniferophytes (the latter name too glaringly hybrid to be acceptable). They include the Cycadofilicales in the former, which is not Nathorst's arrangement, as erroneously stated on p. 59. The two great phyla are regarded as "both differentiating from the Cycadofilicales or each arising independently from the progenitors of the Cycadofilicales" (p. 59). This is a little confusing, for on the former alternative the Cycadofilicales would have differentiated from themselves. It would have been better to leave the Cycadofilicales (Pteridosperms) as an independent ancestral group, lying at the root of all the other branches.

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Chapter ii. is devoted to the Bennettitales, the characteristic Mesozoic Cycadophytes, remarkable for their anticipation of the angiospermous flower.

The authors have been misled by the synonymy in one instance, for they describe *Williamsonia angustifolia* and *Wielandiella* as distinct plants, whereas they are merely two names for the same thing (pp. 66 and 86). A more serious error is the statement that Nathorst confirms the view that the flowers of the Yorkshire *Williamsonias* are *bisporangiate* strobili (p. 76). Nathorst's conclusion is that these flowers were monosporangiate (unisexual).

The derivation of the Mesozoic Bennettitales from the Palæozoic Cycadofilicales will be generally accepted, but the statement that "the bisporangiate character of the strobilus is probably to be explained by the bisporangiate character of the fronds of those Cycadofilicales which gave rise to Bennettitales" (p. 87) is more open to question. We have at present no evidence of the existence of bisporangiate fronds in the Palæozoic group; neither is it necessary to assume their existence in order to explain the association of stamens and carpels in the same flower.

Chapter iii., on the Cycadales, is no doubt the best account we have of this important and fascinating family. A large number of original observations, by members of the Chicago School of Research, are embodied, and there are some very fine new figures.

Dioon edule, a Mexican Cycad, said to attain an age of 1000 years, has now been added to the list of species in which fertilisation by motile spermatozooids has been observed.

The statement that the Cycadales are "probably not so old as either the Ginkgoales or the Coniferales" may need revision. Our records are scanty, but carpels scarcely distinguishable from those of recent species of *Cycas* are known as far back as the Lias.

In the chapter on the Palæozoic Cordaitales there is not much room for novelty, for here our knowledge has advanced but slowly of late. The current views of their affinities are adopted. The related phylum of the Ginkgoales (chapter v.), of which there is only one survivor, the maidenhair tree, is regarded as retaining certain primitive features in common with the Cycadophytes, while it has advanced more in the direction of the Coniferales, and has developed certain peculiarities of its own (p. 217).

Chapters vi. and vii. are on the Coniferales, which, from their extent and variety, naturally demand a fuller treatment than any other group. The account given is excellent, and contains much of interest, but one realises that the Conifer problem still remains to be solved.

The class is divided into Pinaceæ and Taxaceæ, but it is very doubtful whether even this first grouping is natural, for the Podocarps among the Taxaceæ seem to have little to do with the Yews, while they have much in common with the Araucarians among Pinaceæ.

Perhaps too much is made of the supposed special antiquity of the Abietineæ (firs). The arguments in support of the primitive nature of this tribe are not altogether convincing.

In stating that the Taxaceæ have not been recog-

nised further back than the Cretaceous (p. 349), the authors ignore Nathorst's suggestion that the Rhætic genera *Stachyotaxus* and *Palissya* may be early representations of the Podocarps.

The heterogeneous group of the Gnetales forms the subject of chapter viii. We think that more stress might have been laid on the possible affinity, originally suggested by Wieland, between *Welwitschia* and the Mesozoic Bennettitales. The hermaphrodite flowers and monadelphous stamens occurring in *Welwitschia* are striking points of agreement with the extinct group.

The account of the three extremely diverse genera which make up the Gnetales is of much interest, and contains various details hitherto not readily accessible to the student. The relationship of such isolated types, with no known fossil history, necessarily remains obscure.

The final chapter, on "Evolutionary Tendencies among Gymnosperms," previously published in part as a separate paper, sums up the main results. The diagram on p. 409 gives a good idea of the probable evolutionary connections of the various groups, though in one or two points it is not quite consistent with the statements in the text. Though the reviewer does not agree with quite all the authors' conclusions, he is in entire sympathy with their principle that

"the relative position of any form in a scheme of classification can be determined only by averaging all its characters; and its relative age in a scheme of phylogeny can be determined only by the sure testimony of history" (p. 425).

D. H. S.

THE EVOLUTION OF OUR ISLANDS.

The Building of the British Isles, being a History of the Construction and Geographical Evolution of the British Region. By A. J. Jukes-Browne, F.R.S. Third edition, rewritten and enlarged. Pp. xv+470. (London: E. Stanford, 1911.) Price 12s. net.

THIS new edition of Mr. Jukes-Browne's well-known book makes it virtually a manual of the geology of the British Isles. The photographic illustrations bring the relations of the rocks clearly home to us, and many of them are works of art, such as Prof. Reynolds's view of chalk and lavas at Garron Point (Fig. 61), and Mr. R. F. Gwinnell's Miocene folding at Lulworth (Fig. 63). The numerous maps, suggesting the relations of land and water at various epochs, suffer, as all such maps must do, from our ignorance of details. The sweeping boundaries of continents and the generalised forms of firths and sounds are perforce unlike anything that we now know upon the earth. Printed explanations on the maps would greatly aid the reader, such as "area of Bunter pebble-beds," "Lake-basin," and so forth. There is a mysterious dotted line on Fig. 19, for which one must search the text, while much guidance is required for the lines and colours on Fig. 57. The result may, however, be regarded as happy, if the casual reader is sent through a lengthy chapter, to find there a summary of the latest researches, and evidence of a critical mind that looks eastward across Europe. Mr. Jukes-Browne does not hope to